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EXAMINATION PAPERS, 1859.

(*Continued from page* 634.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in May last:—

CONIC SECTIONS.

THREE HOURS ALLOWED.

SECTION I.—GEOMETRICAL CONIC SECTIONS.

(1.) The focus and directrix being given, it is required to define each of the conic sections in reference to them. Hereby prove that the normal at a point of a parabola bisects the angle between the focal distance and the diameter.

(2.) Prove in the parabola that the subtangent is equal to twice the abscissa.

(3.) A is the vertex, S the focus, M the foot of the ordinate, P a point on the parabola, &c. Prove that

(1.) $(MP)^2 = 4\ AS.\ AM.$
(2.) $(QV)^2 = 4\ SP.\ PV.$

(4.) An ellipse being given, find its centre, principal axes, foci, directrices. And show that of all lines drawn from a focus to the curve, that which passes through the centre is the greatest.

(5.) Draw a tangent to a hyperbola from a given point on the curve.

(6.) Prove that the rectangle contained by the perpendiculars from the foci of an ellipse on a tangent is equal to the square of half the minor axis. What form does this theorem take in the parabola?

(7.) Explain a method for describing a hyperbola. Show that by means of a hyperbola any angle may be trisected.

(8.) From a given point on the minor axis of an ellipse draw a normal to the curve. Show that either two or four normals can be drawn from such a point.

(9.) The part of the tangent of a hyperbola which is intercepted between the asymptotes is bisected at the point of contact. Prove this theorem, and hereby show that the area of the triangle contained between the tangent and the asymptotes is constant.

(10.) Define circle of curvature and chord of curvature. Find the radius of curvature and the chord of curvature at any point of a parabola.

(11.) An ellipse is orthographically projected into a circle. What, relatively to the circle, are the projections of (1) a pair of conjugate axes; (2) a pair of supplemental chords; (3) a parallelogram circumscribing the ellipse with its sides parallel to conjugate axes?

(12.) Prove that every plane section of a cone which cuts both the cone and its conjugate cone is a hyperbola.

(13.) Through any point two planes can be drawn cutting an oblique cone, such that the sections of the cone shall be circles.

SECTION II.—ANALYTICAL CONIC SECTIONS.

(1.) Construct formulæ for passing from one rectangular system to another when the origin is unchanged, and transform the equation $x^2-y^2=a^2$ to axes bisecting the angles between the original axes.

(2.) Find (1) the equation to the line passing through (x_1, y_1) and perpendicular to the line passing through (x_2, y_2) and (x_3, y_3); and (2) the length of the perpendicular from (x_0, y_0) on the line thus determined.

(3.) Find the general equation to the tangent of a circle and prove that it is perpendicular to the radius of the circle at the point of contact.

(4.) C is the centre, S and H are the foci, CP and CD are conjugate semi-axes of an ellipse whose equation is $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, show that

(1) $SP=a+ex$, $HP=a-ex$:
(2) $SP \times HP=(CD)^2$.

(5.) Prove analytically the theorems contained in questions 2, 6, 9 of the preceding section.

(6.) Examine and trace the lines represented by the following equations:—

(1) $4x+3y+12=0$
(2) $x^2+y^2-4x-6y-3=0$
(3) $x^2+2xy+y^2-x+y-6=0$
(4) $2x^2-2xy+y^2-4x+6y-10=0$

STATICS, DYNAMICS, HYDROSTATICS, HYDRAULICS, AND PNEUMATICS.

THREE HOURS ALLOWED.

(I.)

(1.) Define the terms pressure, velocity, momentum, accelerating force, moving force; and illustrate by examples.

(2.) State and prove the conditions of equilibrium on an inclined plane.

(3.) What principle must be assumed in order to prove the property of the lever? Describe the different kinds of levers; and illustrate by examples.

(4.) Explain the principle of the Archimedean screw for raising water.

(5.) Shew that the density of air is proportional to the compressing force.

(6.) What is the law of inertia? Give proof and examples.

(7.) Explain the principle of Barker's mill.

(8.) Action and reaction are equal and in opposite directions. Is this universally true, or under what conditions? Give proof.

(9.) What is the nature and law of centrifugal force? Give proofs and examples of its application.

(10.) What mechanical powers are employed in rowing, sailing, and steering a boat?

(11.) Why does a person in carrying a weight on his back, bend forward; in front, backward, and on his head, keep upright?

(12.) Describe the essential parts in the construction of a clock, a watch, and a chronometer.

(II.)

(13.) If a body move from rest by a constant force, shew that the space described, from the commencement, varies as the square of the time, experimentally or mathematically.

(14.) In the same case, prove that the space described is half that which would be described in the same time with the last acquired velocity continued uniform.

(15.) State and demonstrate the chief properties of a simple pendulum; vibrating either in a cycloid or in a small circular arc.

(16.) Explain the compensation pendulum, and describe any varieties of construction.

(17.) Explain the application of the barometer to the measurement of heights.

(18.) Define the centre of gravity of a body, and find its position, either experimentally or mathematically, in a triangle, a semi-circle, a parabola, supposed of uniform density.

(19.) What is capillary attraction? Describe any experiments illustrative of its nature and laws.

(20.) Define the "principal axes" of a rotatory body, and mention any experimental illustration of the case.

(21.) Explain the "composition of rotatory motion," and mention any remarkable application of the principle.

(22.) Describe the gyroscope; explain the principle of its application to showing the rotation of the earth, and the suspension of a rotating disk against gravity.

(23.) State the law of "conservation of areas." Give any proof of it, experimental or mathematical, and state any remarkable application of it.

(24.) Define "moment of inertia," and show the means of finding the "centre of gyration" of a body.

PRACTICAL MECHANICS.

THREE HOURS ALLOWED.

(1.) Describe the screw-cutting lathe. What is the pitch of a screw? How are screws of a different pitch cut in the lathe? Explain the arrangement for cutting left-handed screws.

(2). Show that power may be gained by combinations of toothed wheels, and give the illustration which occurs in the double geared headstock of a turning lathe.

(3.) Describe the common mangle wheel, and state some methods of obtaining a reversing motion in machinery.

(4.) Explain the principle of the fire engine and of the centrifugal pump.

(5.) What is the dynamical statement of the Principle of Work. Find the amount of work stored up in a fly-wheel of given form and weight, and making a given number of revolutions per minute.

(6.) Mention some experiments to prove that the pressure of steam from water boiling in the air is equal to that of the atmosphere. Explain the advantage of working steam expansively, and state generally the properties of steam.

(7.) Describe the common condensing beam engine.

(8.) What is the horse power of an engine, and how is it ascertained?

(9.) Describe the eccentric. Explain the contrivance for reversing a locomotive engine.

(10.) Discuss the nature of the action which takes place between the pendulum and the clock train in the cases of the recoil and dead beat escapements.

(11.) What is the general arrangement of a sawing machine. How is the piece of timber advanced for each cut.

(12.) Describe the hydrostatic press. Show how to calculate the power called forth. Give details of the working parts, and state some useful applications of this machine.

ELECTRICITY, MAGNETISM, AND HEAT.

THREE HOURS ALLOWED.

(1.) Explain magnetic induction, and the conditions of magnetic attraction and repulsion.

(2.) Give some account of the distribution of terrestrial magnetism. What are isodynamic lines?

(3.) In what manner is terrestrial magnetism influenced by solar heat?

(4.) Explain diamagnetism, and mention some substances that exhibit this property.

(5.) State the phenomena accompanying the excitation of electricity by friction.

(6.) Explain the construction and action of an electrophorus.

(7.) Give some account of the apparatus for protecting ships from lightning, and the conditions essential to its action.

(8.) Describe a voltaic element, and its mode of action.

(9.) Explain the terms, quantity, and intensity, in relation to a battery, and state under what circumstances these different conditions are required.

(10.) Explain the construction and action of a dry pile.

(11.) By what arrangements are magnetic properties developed by a voltaic current? Mention some practical applications.

(12.) What are the peculiar characters of a thermo-electric current, and by what means is it produced?

(13.) Describe the electric organs of some animal possessing them.

(14.) State and explain the effect of a galvanic current on muscular action.

(15.) Explain the construction of a submarine cable.

(16.) What is the construction and object of a "relay?"

HEAT.

(17.) State the influence of heat on the physical properties of bodies.

(18.) What is meant by the convection of heat? Describe some apparatus acting on this principle.

(19.) Explain the means of measuring heat, and the principal sources of error.

(20.) If a vessel containing water heated to 300° C. were suddenly opened, would the whole, or what proportion of it, fly off in steam.

(21.) Show by experiments that heat obeys the ordinary laws of reflexion.

(22.) State the conditions essential to efficient ventilation.

(23.) Explain the "dew point," and the means of observing it.

(24.) On what conditions does the difference in the sensible warmth or coldness of two substances, as wood and iron, at the same temperature, depend? Apply this principle to clothing.

(To be continued.)

NAPHTHA.

By M. C. COOKE.

A considerable number of inflammable mineral substances are known under the names of asphaltum, bitumen, petroleum, and naphtha, differing in colour and solidity, but these names are often applied very indiscriminately, and, as at present commonly used, do not denote precisely the character of the substance so named. Generally, however, the limpid, yellowish, transparent fluids are called *naphtha*. These on exposure to the atmosphere evaporate partly, leaving a substance nearly black, and of the consistence and colour of tar, which is then called *petroleum;* in this form it also oozes from the earth in many places. A third kind is solid, with a glossy conchoidal fracture, resembling pitch, and this either bears the name of *bitumen* or *asphaltum*. Recent applications of these bituminous substances have suggested a short account of the principal sources whence they have been obtained. To classify them under the three heads above named would not be a task so readily performed, from the accounts we possess, and in the absence of specimens for comparison. In some instances, two or more of the varieties are also found in the same localities. Hence the only arrangement which can be adopted is a geographical one. Comprising:—

1. European, *i.e.*—British and Continental.
2. Asiatic—Western and Eastern.
3. American—North, South, and Insular

The British sources of bituminous substances are not so numerous or prolific as to render them available to any extent commercially. In Derbyshire it has been pumped up from certain coal mines, sometimes in considerable quantity. Dr. Ure states to the extent of 100 gallons daily. In Shropshire it has also been obtained; also in Lancashire and Cornwall. In Scotland, asphaltum has been found in East Lothian, and naphtha at St. Catherine's well, near Edinburgh, and in Pomona, one of the Orkneys.

A kind called *elaterite*, or elastic bitumen, of rare occurrence, has been found near Castleton, in Derbyshire, in a coal mine a few miles from Angers in France, and in a coal mine in Massachusetts, in the United States. This substance resembles in many of its properties the gum elastic, or fossil caoutchouc; it fuses readily, and at a higher temperature takes fire, and burns with a

sooty flame, but from its scarcity no attempt has been made to utilize it, and therefore it is of no commercial value.

In continental Europe there are numerous naphthaline springs. At Monte Ciaro, near Piacenza; at the lake of Tegern, in Bavaria; near Neufchatel, in Switzerland; in the department of Ain, in France, bitumen is accompanied with a copious flow of water on which it floats, and from which it is skimmed. There are also abundant supplies in several parts of the Duchy of Modena. Pietra Mala, Fanano, Mount Zibio, and Amiano, furnish the naphtha of the Genoese markets. The naphtha of Amiano is of a topaz yellow colour, and readily burns without leaving any residue. It rises in considerable quantities, and is used for lighting. A spring was noticed by Benjamin, of Tudela, at Puzzuola in the twelfth century. "This city," he writes, "has been inundated in two spots by the sea, and even to this day you may see the streets and towers of the submerged city. A hot spring which issues forth from under the ground produces the oil called petroleum, which is collected upon the surface of the water and used as medicine." There are also springs at Zante which are known to have been at work for upwards of 2,000 years. Herodotus wrote of them in the following words:—"I have myself seen pitch drawn up out of a lake, and from water in Zacynthus; and there are several lakes there, the largest of them is seventy feet every way, and two orgyæ in depth; into this they let down a pole with a myrtle branch fastened to the end, and then draw up pitch adhering to the myrtle; it has the smell of asphalt, but is, in other respects, better than the pitch of Pieria. They pour it into a cistern dug near the lake, and when they have collected a sufficient quantity they pour it off from the cisterns into jars. All that falls into the lake passes underground, and appears again upon the surface of the lake, which is about four stades distant from the lake." These wells are situated about 12 miles south of the town of Zante, in a marshy district in the south-east part of the island.

The valley containing the bitumen is the segment of a circle, surrounded on three sides by abrupt and rugged ridges of hills, and on the fourth by rocks rising above the water as if the sea had at some period burst in and destroyed the continuity. In the marsh within the circle are several wells or pits; one examined was about nine feet in diameter and surrounded by a dwarf wall. The water was about two feet below the edge, and one foot deep, the surface covered with a scum which reflects various iridescent colours; the blue and green are very vivid, a dark black substance continually forcing its way from the bottom, and boiling up in large globules, which as they ascended enlarged, till near the surface, and then burst, liberating a quantity of gas which the peasantry say is highly inflammable. Sometimes the globules are transparent, and assume a singular brilliancy, rising to the top and bursting, while a coating of dark bituminous matter in which they were invested is thrown off. This dark substance is the petroleum or rock-pitch, which being specifically heavier than the water remains below, covering the sides and part of the bottom. The brilliant globules disengaged from it are pure naphtha, which forms a light oleaginous strata above, reflecting various beautiful colours. The intervening water is strongly impregnated with a taste like tar-water, and it is prescribed in various dyspeptic complaints. The pitch is collected with large spoons into a pit adjoining the well, and thence thrown into barrels. The best time for gathering it is in summer, when it is exuded in the greatest quantities; and they annually fill about 100 barrels, which is used for smearing the bottom of ships and similar purposes.—Martin.

In several places in Sicily are fountains which throw up a kind of earth oil on their surface, which is used by the peasants, who burn it in their lamps, and use it for many other purposes. But there is a more remarkable one near Nicosia, which is called Il Fonte canalotto. It is covered with a thick scum of a kind of pitch, used by the country people as a specific in rheumatism. Petroleum has also been obtained at Puklemicza in Hungary, at Tegernsee, in Transylvania, in Moldavia, and in Wallachia. A solid kind has been found in limestone at Bleiberg, in Carinthia, in beds of sandstone in Albania, and in veins in the Hartz, in Germany. The asphalt of Seyssel and other parts of France and Switzerland has been long used for paving. The Pyrenees and the Caucasus are also affirmed to yield varieties of this substance.

The principal bituminous districts of Western Asia are those of the Tigris, the Caspian, and the Dead Sea. The former of these are, in part, described by Mr. W. Ainsworth:—"Leaving Wadi-l-Kasab, we approached the Tigris a few miles below the tomb of Sultan Abdullah, and came to a level naked spot inclosed by rocks of gypsum, on the floor of which were innumerable springs of asphalte or bitumen oozing out of the soil in little circular fountains from six to 9 inches in diameter, but often buried beneath or surrounded by a deep crust of indurated bitumen. These fountains cover a space of land nearly a hundred yards in width and five hundred long. To the west are some low hills, named Al Kayyarah, or the pitch place. These heights are continued inland in a north-westerly direction, separating Wadi-l-Kasab from the plains to the south, and rising to a height of about 500 or 600 feet to form a cliff bounded by two cones, and called Tell-al-Nujm or Star mound. A little beyond these pits we found other springs giving off an equal quantity of bitumen. These are the only cases I know of springs of pure asphalte in Western Asia. The celebrated springs at Hit, and those of Doulakee, in Persia, give off bitumen as a swimming product as at Hammam Ali. The fountains of asphalte on the Tigris are situated near the southern extreme of the gypsum formation, where it is succeeded by red sandstone, &c."

At the thermal springs of Hammam Ali the waters are abundant, evolving hydro-sulphurous acid, and giving off much bitumen.

The springs called Oyun Hit (the fountains of Hit) are celebrated by the Arabs and Persians; the latter call them *cheshmeh kir* (the fountain of pitch). This liquid bitumen they call *nafta;* and the Turks, to distinguish it from pitch, give it the name of *kara sakiz* (black mastic). A Persian geographer says that nafta issues out of springs of the earth, as ambergris issues from those of the sea. All modern travellers, except Rauwolf, who went to Persia and the Indies by way of the Euphrates, before the discovery of the Cape of Good Hope, mention this fountain of liquid bitumen as a strange thing. Some of them take notice of the river mentioned by Herodotus*, and assure us that the people of the country have a tradition, that when the tower of Babel was building, they brought the bitumen from hence, which is confirmed by Arab and Persian historians.

The following quaint account is given of these springs:—

"Hit, Eit, or Ait, as it is variously written by travellers, is a great Turkish town, situate upon the right or west side of the Euphrates, and has a castle, to the south-west of which, and three miles from the town, in a valley, are many springs of this black substance, each of which makes a noise like a blacksmith's forge, incessantly puffing and blowing out the matter so loud that it may be heard a mile off; wherefore the Moors and Arabs call it Bab al Jahennam, that is, hell-gate. It swallows up all heavy things, and many camels from time to time fall into the pits, and are irrecoverably lost. It issues from a certain lake, sending forth a filthy

* Eight days' journey from Babylon stands another city, called Is, on a small river of the same name, which discharges its stream into the Euphrates; now this river brings down with its water many lumps of bitumen, from whence the bitumen used in the wall of Babylon was brought.—Herodotus I. 179.

smoke, and continually boiling over with the pitch, which spreads itself over a great field that is always full of it. It is free for everyone to take; they use it to caulk or pitch their boats, laying it on two or three inches thick, which keeps out the water; with it also they pitch their houses, made of palm-tree branches. If it was not that the inundations of the Euphrates carry away the pitch, which covers all the sands, from the place where it rises to the river, there would have been mountains of it long since. The very ground and stones thereabout afford bitumen, and the fields abundance of saltpetre."

A later traveller states that "the number of bitumen springs in the neighbourhood of this place is very great, and the produce of a single spring is sufficient to meet the demand, though it is used in these parts as fuel. A great number of river boats, of different sizes and forms, are made here. They consist of wicker work, made of branches from one-and-half to two inches in thickness. The interstices are filled up with straw, and then the whole is caulked with bitumen. In such boats the bitumen, salt, and prepared lime, are taken to Hillah, Bassora, and Baghdad."

Major Rawlinson states that, at the pits of Kir ab ur Susiana, the liquid bitumen is collected at the present day in the same way as is related by Herodotus.* The ground is impregnated with this noxious matter, and the waters are most unwholesome.

There are, besides, other pits at Bandi Kir, and near Ram Hormuz.

Of the Persian naphtha or petroleum, there are said to be two kinds, the white and the black. Of the latter, there are several fountains in Irak Arabi, but the most productive are near Kerkook. It is employed by the natives as a substitute for pitch, and is also used in lamps instead of oil. The white naphtha is found floating like a crust on the surface of the water; it is of a much thicker consistence, resembling tallow rather than pitch, and affords a better light, as well as emits a less disagreeable odour than the black naphtha. Two fountains of this kind rise near Doulakee, in Fars, but the most remarkable are found near Baku, on the western shores of the Caspian. A liquid black petroleum, of an agreeable odour, flows in small quantities from a mountain in Kerman; this was formerly a Royal monopoly, and the mines were carefully sealed and guarded.

Caspian District.—The peninsula of Apscheron abounds in bitumen. Round the town of Baku there are nearly one hundred bituminous springs, some of which are worked, supplying petroleum and black and white naphtha. Other fountains in the neighbourhood have for ages emitted a burning stream which is called the "Indian fire." The naphtha with which the soil is charged not only streams spontaneously through the surface, but rises wherever a hole is bored. It is of two descriptions, black and white, and the principal sources are situated at a spot called Balegau, about six miles from Baku. The colour of the oil is black, but it shines with a reddish tint when the suns rays are upon it; the natives use it for burning as a light, and paint their roofs with it. Not far from the same spot a spring of white oil gushes out at the foot of a hill. It readily inflames, and burns on the surface of the water, and in calm weather the people of the country amuse themselves by pouring whole tons of it into a bay of the Caspian; they then set fire to it, and it is borne out of sight, giving the waves the appearance of a sea of fire. The whole of these naphtha springs belong to the Government. The weavers and other poor persons of the neighbourhood obtain a cheap light and abundance of heat for cooking, by driving a clay pipe or hollow reed, steeped in lime water, into the ground on which their dwelling stands, and setting fire to the gas which rises through it. The Asjur Meisjan or Burning Field, near Baku, is a hollow expanse, full of fissures, and coated with white sand and grey dust, in which particles of sulphur abound. Some fissures are seen burning, some smothering, and others emitting naphtha vapours. There is a boiling lake not far from the town, which is in constant motion and gives out a flame, altogether devoid of heat. After the warm showers of autumn, when the atmosphere is scorching, the whole surrounding country appears to be on fire, and it frequently rolls along the mountains in enormous masses, and with incredible velocity. At other times it stands motionless. If the night be dark, innumerable jets of flame, sometimes isolated, and at others in masses, cover all the low ground, leaving the mountains in obscurity. The fire does not burn, and when in the midst of what every one would conceive to be a devouring element, it is impossible to detect the least heat in it. The reeds and grass are in no way affected by it. These appearances never occur when the wind blows from the east.

Petroleum is also found in great quantities on the island of Naphthalia or Tchilehon, the largest of the islands of the Caspian sea, situated in the Bay of Balkau.

The soil near Derbent, on the north-west coast of the Caspian, and near the gulf of Baku, from which the naphtha oozes into wells about thirty inches deep, is a clay marl which is thoroughly soaked with that fluid. It has a pale-yellow colour like that of Amiano, but has a specific gravity of 0·853, while that of Amiano is only 0·836; their boiling point is 305° Fahr. Barbados tar differs from these naphthas only in containing a little more bitumen, but it is equally fragrant.

Dead Sea District.—The Arabs call the asphalte of the Dead Sea *Hajar Mousa* (Moses's Stone). It is found floating on the surface of the sea, or scattered in lumps along the shore.

The Arabs who accompanied Dr. Robinson believed that it appears only after earthquakes. They related that after the earthquakes of 1834, a large quantity of asphaltum was cast upon the shore near the south-western part of the sea, of which the Jehâlin brought about 6,000 lbs. into the market. After the earthquake of 1837, a large mass of bitumen, one said like an island, another like a house, was discovered floating on the sea, and was driven aground on the western side, not far to the North of Usdum. The Jehâlin and the inhabitants of Yutta swam off to it, and cut it up with axes, so as to bring it to the shore. The Ta Amirah heard of it, and went to get a share. They found seventy men already upon and around it. This mass of bitumen was carried off by camel loads. It is only in the southern portion of the sea, so far as Dr. Robinson ascertained, that bitumen is obtained. Bitumen wells, it is said, have been found at the northern extremity of the land.

In Eastern Asia, bituminous substances have been found in Burmah, on the Aracan coast, in China, and Japan. The best known are the Burmese springs. At Rangoon, on one of the branches of the Irawaddy, there are upwards of five hundred naphtha and petroleum wells, which afford annually 412,000 hogsheads. The Rangoon wells are about two miles from the village of Yay-nan-Goung, where they occupy a space of about twelve square miles. They are from 200 to 300 feet deep, of small calibre, and sustained by scantling. The temperature of the oil when first raised to the top is 89°; men do not go down, but an earthern pot is lowered in and drawn up over a beam across the mouth, by two men running off with the rope. The pot is emptied into a little pool, where the water with which it is largely

* "At Ardericca (Kir ab) is a well which produces three different substances, for asphalt, salt, and oil are drawn up from it in the following manner:—It is pumped up by means of a swipe, and instead of a bucket half a wine-skin is attached to it; having dipped down with this, a man draws it up, and then pours the contents into a reservoir, and being poured from this into another it assumes three different forms; the asphalt and the salt immediately become solid, but the oil they collect, and the Persians call it *rhadinace*; it is black and emits a strong odour." —Herodotus VI. 119.

mixed subsides, and the oil is drawn off pure. It is exported in earthern jars containing about 30 pounds. The price about twenty years ago was about 2½d. per lb. A well yields about 1,200 or 1,500 lbs. per day, and is worked by three or four men. Sometimes upwards of 2,000 lbs. are obtained. The amount depends on the quantity of water drawn up with the oil. A duty of $\frac{1}{20}$th is paid to the government. This useful oil is extensively used for lamps and torches, and is exported to all parts of the empire, whither it can be taken by water. It is also used for preserving wood, mat partitions, palm leaf, &c., from insects, and from the weather. Even the white ants will not attack wood which has been brushed with it.

In the salt-wells of the province of Sse-tchouen, in China, a bituminous oil is found, that burns in water. Sometimes as many as four or five jars, of a hundred pounds each, are collected in a day. The oil is very fetid, but it is made use of to light the sheds in which are the wells and cauldrons of salt. The mandarins, by order of the Prince, sometimes buy thousands of jars of it, in order to calcine rocks under water, that render the navigation perilous. When a shipwreck takes place, the people make a kind of lamp of this oil, which they throw into the water near the spot, and then a diver, and oftener still a thief, goes down to search for any article of value that he can carry away, the subaqueous lamp lighting him perfectly. Strong bituminous vapours issue from the earth, which are lighted at the surface, and serve as fires for evaporating the water obtained from the wells to procure the salt. Thus much is related by Mr. Imbert, a missionary for a long time in this province.

Capt. Halstead, of H.M. ship *Childers*, collected specimens of petroleum at Cheduba, on the Aracan coast. The colours varied from cherry red to nearly opaque tar-like brown. This petroleum appears to be nearly identical with that of Barbados and Persia.

Naphtha of a reddish colour, by the Japanese called *tsutsono abra*, which signifies red earth, is found in a river of the province Jessing, in Japan. It is taken up in such places where the water has little or no run, and the natives burn it in lamps instead of oil.

A similar substance, called stone oil, is also found in parts of the Chinese Empire; and it has been noticed in Siberia and in the Altai mountains.

AFRICA.—No part of Africa with which we are at present acquainted, would appear to yield naphtha or asphalte, with the exception of the Atlas mountains, and Egypt. From the latter place petroleum, resembling in colour and consistency that of Barbados, has been exported, as well as solid asphalte, although from what part of the country obtained we are unable to state.

NORTH AMERICA.—In North America it has been found in several places. Mr. Dana says that, in the United States it was formerly collected for sale by the Seneca and other Indians. The petroleum is therefore called Genessee or Seneca oil, under which name it is sold in the market. Beside the springs at Seneca Lake and in Kentucky, there are also springs in Newfoundland, Nova Scotia, and New Brunswick. Sir J. Richardson states that, on the banks of the Mackenzie river there are different beds, containing variable quantities of bitumen. "The whole country is so full of it for many miles, that it flows readily into a pit dug a few feet below the surface."

In Texas there is reported to have been discovered recently a lake very similar to that of Trinidad. "It is situated in Jefferson County, about a hundred miles from Houston. It is about a quarter of a mile in circumference. In the summer months there is a spring near the middle of the lake, where an oily fluid, like petroleum, continually boils up from the bottom. This liquid gradually hardens on exposure to the air, and forms a black pitchy substance. It burns when lighted with a clear bright light, but gives out a very pungent odour. During the winter the bitumen in the lake presents a hard surface, and is covered with water having a somewhat sour taste."

About 1830, while boring for salt-water near Burksville, Kentucky, after penetrating through solid rock upwards of 200 feet, a fountain of pure petroleum was struck, which was thrown up more than twelve feet above the surface of the earth. Although in quantity somewhat abated after the discharge of the first five minutes, during which it was supposed to emit seventy-five gallons a minute, it still continued to flow for several days successively to the mouth of a small creek, emptying into Cumberland River, and for a long time covered its surface. Some gentlemen below applied a torch, when the surface of the river blazed, and the flames soon climbed the most elevated cliffs, and scorched the summit of the loftiest trees.

In Canada, petroleum is found on the Thames, River St. Jean, and Ruisseau Argenté (Gaspé), and Asphaltum, at Enniskillen.

SOUTH AMERICA.—For accounts of the South American sources of these products we are chiefly indebted to Humboldt.

In the gulf of Cariaco petroleum issues from a soil of mica slate. Further east, on the banks of the Arco, and near Cariaco, it seems to gush from secondary limestone formations, but probably that happens only because those formations repose on mica slate.

Proceeding along the southern coast, to the east of Maniquarez, we find running out into the sea, very near each other, three strips of land, bearing the names of Punta de Soto, Punta de la Brea, and Punta Guaratarite. In these parts the bottom of the sea is evidently formed of mica slate; and from it, near Cape de la Brea, but at eighty feet distant from the shore, there issues a spring of naphtha, the smell of which penetrates into the interior of the peninsula. The bottom of the gulf is covered with sand, and the petroleum, which from its transparency and its yellow colour resembles naphtha, rises in jets accompanied by air-bubbles. On treading down the bottom with the foot, we perceive that these little springs change their place. The naphtha covers the surface of the sea to more than a thousand feet distant.

In the muriatiferous clay of Araya is found a solid and friable petroleum, and in the peninsula of Araya the naphtha flows from the primitive rock itself.

From Punzera, the road leads by Torecin and Nuova Palencia to the port of San Juan, situated on the right bank of the river Areo, and it is only by crossing this river in a canoe that the traveller can arrive at the famous petroleum springs of the Buen Pastor. They were described to Humboldt as small wells or funnels hollowed out by nature in a marshy soil. From hence the lake of chapapote, of Laguna de la Brea, in the island of Trinidad, is distant, in a straight line, only thirty-five sea leagues.

A petroleum spring also gushes from a shoal to the north of the Caracas Islands. The smell of this spring warns ships of the danger of this shoal, on which there is only one fathom of water.

The aperture of Mena, on the borders of Lake Maracaibo, throws up asphaltum, and is said to emit gaseous emanations, which ignite spontaneously, and are seen at a great distance.

The asphaltum springs of Trinidad are, however, the most important of the South American bituminous exhalations, for they must be considered as belonging to South America, and at the same time forming a link between them and the springs of the West Indian Islands.

The pit which throws up asphaltum in the Bay of Mayaro, on the Eastern Coast, southward of Point Guataro, is the mine of chapapote, or mineral tar of the country. Humboldt was assured that, in the months of March and June, the eruptions were often attended with violent explosions, smoke, and flames.

South-east of the port of Naparimo, in a clayey ground, appears the celebrated lake of asphaltum, a marsh, the waters of which have the same temperature as the atmosphere.

Petroleum is found floating on the sea thirty leagues north of Trinidad, around the island of Granada, which contains an extinguished crater, and basalts.

Dr. Nugent, writing of the Trinidad lake, says, "We soon after had a view of the lake, which, at first sight, appeared to be an expanse of still water, frequently interrupted by clumps of dwarf trees, or islets of rushes and shrubs, but on a nearer approach we found it to be in reality an extensive plain of mineral pitch, with frequent crevices and chasms filled with water. The singularity of the scene was altogether so great, that it was sometime before I could recover from my surprise so as to investigate it minutely. The surface of the lake is of the colour of ashes, and at this season was not polished or smooth so as to be slippery; the hardness or consistence was such as to bear any weight, and it was not adhesive, though it partially received the impression of the foot; it bore us without any tremulous motion whatever, and several head of cattle were browsing on it in perfect security. In the dry season, however, the surface is much more yielding, and must be in a state approaching to fluidity, as is shown by pieces of recent wood and other substances being enveloped in it. Even large branches of trees, which were a foot above the level, had, in some way, become enveloped in the bituminous matter.

The interstices, or chasms, are very numerous, ramifying and joining in every direction, and in the wet season being filled with water, present the only obstacle to walking over the surface. These cavities are generally deep in proportion to their width, some being only a few inches in depth, others several feet, and many almost unfathomable. The water in them is good, and uncontaminated by the pitch. The people of the neighbourhood derive their supply from this source, and refresh themselves by bathing in it. Fish are caught in it, and particularly a very good species of mullet. It is not easy to state precisely the extent of this great collection of pitch; the line between it and the neighbouring soil is not always well defined, and, indeed, it appears to form the substratum of the surrounding tract of land. The depth cannot be ascertained, and no subjacent rock or soil can be discovered. Where the bitumen is slightly covered with soil, there are plantations of cassava, plantains, and pine apples, the last of which grow with luxuriance and attain to great perfection. In some parts it is so hard as to require a severe blow of the hammer to detach or break it. In other parts it is so much softer, as to allow one to cut out a piece in any form with a spade or hatchet, and in the interior is vesicular and oily; this is the character of by far the greater portion of the whole mass. In one place it bubbles up in a perfectly fluid state, so that you may take it up in a cup, and I am informed that, in one of the neighbouring plantations, there is a spot where it is of a bright colour, shining, transparent, and brittle, like bottle glass or resin. The odour in all these instances is strong, and like that of a combination of pitch and sulphur. A bit of the pitch held in the candle melts like sealing wax, and burns with a light flame, which is extinguished whenever it is removed, and on cooling the bitumen hardens again.

Combined with sand and rubble this asphalte is stated to form a good paving for the chief town of Port of Spain. It is proposed to utilise it on a large scale, and by mixing it with chips of wood, to obtain every year *5,000 tons* of fuel, by which the West India steamers could save much of the coal they are obliged now to carry with them from England.

In the island of Barbados are several bituminous springs which yield the substance known as Barbados tar. Near Springfield, in a ravine formed by two mountains, is a surprising quantity of petroleum. In the neighbourhood of Conset's Bay rises a hill which is locally known under the name of Burnt Hill. It is reported as having been set accidentally on fire by a slave, and that it continued to burn for the space of five years. Petroleum oozes in large quantities out of the rocks near the beach. Among the shingle are found large cylindrical bodies consisting of ferruginous clay coated with bitumen. Near Mount All is a spring called "The Pottery," on the surface of which floats plentifully, naphtha, or green Barbados tar.

After the adoption of the manufacture of gas from coal, it was found that the substance called coal tar, one of the products of this manufacture, very closely resembled Barbados tar in its physical character; and for many years coal tar was almost entirely substituted for, and sold under, the name of Barbados tar in this country. Coal tar also yields, by distillation, a volatile fluid, which has been called naphtha.

The Barbados green tar, or petroleum, has been used with success in cases of leprosy. Mr. Abel Stuart petitioned the House of Assembly to erect upon Bird Island a hospital for the more convenient prosecution of his labours in the cure of leprosy by means of the green tar.

In some places in the Island of Cuba petroleum flows from rents in the serpentine. Sebastian de Ocampo, in 1508, employed a substance called "betun liquido," for the caulking of ships. This was near the port of Havanna. It is said that abundant springs are also found in the eastern part of the Island, between Holguin and Mayari, and on the coast of Santiago de Cuba.

This enumeration of the sources of naphtha, and its allies is doubtless imperfect, but in the absence of any collected information on the subject this attempt may furnish some assistance either to those interested in the commerce or extended utilization of these substances, or to any who may be desirous of forming for themselves a more complete digest of the distribution of this mineral over the surface of the globe.

COPPER COINAGE.

The condition of copper coinage of this country has been under investigation by the Government. A large portion has been found to be in a very bad condition. A considerable part of it is very old. Rather more than one-fifth bears dates between 1797 and 1805. It varies in weight, and although the practical inconvenience is perhaps not very great, because the public are familiar with it, yet if an old and a new penny were shown to persons unacquainted with them, no one would ever dream that they represented the same value. The old penny is worth intrinsically nearly half as much again as the new one. The old penny was coined at the rate of sixteen to the pound, and the lightest of the new twenty-six to the pound. Only fifteen per cent. of the copper coinage dates since 1852. The whole value of the copper coinage is £800,000, and the quantity of copper is 3,530 tons. Taking the copper at £107 10s. per ton, the actual value is only £379,000, so that the copper coin is a pure token, the intrinsic value being less than one-half the nominal or apparent value. In order to ascertain the state of the copper coinage a considerable quantity has been examined in the large towns. The copper coinage of towns is better than that of the country, because old coins always linger longer in the rural districts. The result of the investigation in London, Birmingham, and other large towns shows that about one-third of the whole is below its legal state, and ought to be withdrawn. A part of it is counterfeit, another part consists of foreign coins, and another part is injured, battered, and inscribed, according to the fancy of individuals. The result is that one-third requires renewal. If it were renewed, such as it now is, a cost of about £40,000 would be incurred, but by the mode intended to be adopted by the Government, although an outlay of £50,000 will be

required in the first instance, this expense will be entirely covered by the profit arising from the change of material. The Chancellor of the Exchequer, in his speech in Parliament, explained the intentions of Government as follows:—

"He believed the copper coinage admitted of considerable improvement. It was exceedingly heavy, and the metal was not very agreeable handling. It communicated a smell, and it was very easy to substitute a metal more convenient. It would be an admirable practice to follow in the beat of our continental neighbours. Gentlemen would recollect what was the state of the old copper coinage of France. It was much the same as our own. The coins had almost lost all signs of any effigy, and were rudely shaped lumps of metal. Within the last few years it had been called in, and a bronze metal substituted. He held in his hand a French penny, which was a very little larger than an English halfpenny. It was very convenient, very nice in appearance, and a most agreeable coin to handle. It was a much more desirable coin than ours, and the result of the operation, as he was informed, had been that the French had paid for the expense of converting the coin, and realised from the reduction of weight a profit not far short of £500,000. No such profit could be expected in this country, the quantity of copper coinage not being so great. But relative to its extent there was no reason why the operation should not leave a profit analogous to that obtained in France. The new copper coinage would not effect any question of the currency or computation; it would leave all such matters exactly as they were; nor would it have anything to do with the decimal system. If we only substitute for the present coins pieces harder, more convenient, and more agreeable, he did not doubt the public would have equal confidence in them. The effect of improving the copper coinage will be to produce a largely increased demand for it. In Paris the increase in the demand after the new coins were issued was 50 per cent. This experience was very encouraging, as a larger demand would be attended by increased profit. The metal proposed to be used for the new coins was bronze; it contained four parts of tin and one part of zinc to 95 parts of copper, which was increased in hardness by the alloy. In reference to this point he should mention that there was a Bill passing through the House, extending the penalties for forging the copper coinage to forging coins of the mixed metal. There was some doubt whether these penalties were incurred by the forging coins of a mixed metal, and as a precaution it had been thought better to introduce the Bill. The new coins would be much lighter than those in present use; the change of metal would enable them to be made much thinner in proportion to their superficies, and their intrinsic value would not be more than half that of the present coins. The quantity of copper now coined into 26 of the old pence would make 45 of the new ones. If the 3,500 tons of the old copper were called in and recoined, the profit would be about £92,000; but if there was an increased demand for the new coin, to the amount of 25 or 30 per cent., that would leave a considerable profit on the operation. One great advantage of the new coin would be its superior durability. The use of bronze was not new to the Mint: the metal had been tried for coinage in Canada and Nova Scotia, and the new issue here would resemble the small coinage adopted in those colonies."

Experiments it is understood have been made with a view to ascertain whether aluminium bronzes would be suitable. It was found, however, that these bronze mixtures, varying from 5 to 10 per cent. of aluminium, tarnished rapidly in wear, and besides being still too costly for adoption.

Home Correspondence.

THE WESTMINSTER CLOCK.

SIR,—It is now more than two years since the controversy between Mr. Denison and myself concerning the Westminster clock and bell appeared in the *Journal of the Society of Arts*, the *Mechanics' Magazine*, *Builder*, and some of the daily newspapers. That controversy, which was commenced in November, 1856, in the newspapers, and continued till April 1857 in the magazines, contained suggestions which would have prevented the principal failures that have since occurred if the Government had acted upon them. Some of the subsequent failures have become public, but the persons responsible for them have ungenerously shifted the blame from their own shoulders on to others. The question of who is responsible for the failures was mooted in the House of Commons on Friday, 15th July, and as no satisfactory answer was elicited, I propose supplying the deficiency to some extent in this and a subsequent letter, and in doing so, perhaps I should claim some credit for forbearance when the first bell was broken, in not then calling attention to the fact of the bell having been destroyed by the clapper, which, throughout the last controversy, I had pointed out as being so enormously heavy compared with the weight of the bell and the size of the clock that was to work the equally disproportionate hammer. A reference to the publications already mentioned will show that the tone in which my statements were contradicted was sufficient to have justified the earliest opportunity being taken of recurring to the subject after events had confirmed my opinions.

The easiest way of arriving at the difference between what the clock was to have been, and what it really is, will perhaps be to go through the excellent conditions originally laid down by the Astronomer Royal for the construction of the clock, and select the chief of those which have not been fulfilled.

The first condition not fulfilled is the one which required the wheels to be made of hard gun-metal, with the teeth cut to the epicycloidal form. Instead of this the wheels have been made of cast-iron, which is the cheapest material that could be used, and the teeth have been cast in, instead of being cut, whilst a large sum has been added in the contract for the change, under the plea of the extra labour required in cutting and working cast-iron; whereas it now appears that the wheels are destitute of the promised workmanship, and that they are merely left from the casting. These deviations have been effected at Mr. Denison's instigation, and he is the person responsible for them.

A second condition required the escapement to be the dead beat, or something equally accurate. Instead of this the escapement employed is a modification of the gravity escapement, which in its most perfect form has occasionally been proved to fail even for small astronomical clocks, and as the power in the Westminster clock must of necessity be some hundred of times greater, its employment there is certain to result in failure. For this deviation Mr. Denison is responsible.

A third condition required that the minute hand should move over the half-minute or minute space at once, so as to enable the time to be observed outside within a second. The plan for carrying out this condition has so completely failed that the condition itself has been abandoned. Mr. Denison designed the plan, and is responsible for its failure. The forfeiture of this condition is remarkable, for it is the one concerning which Mr. Denison ridiculed Mr. Vulliamy for hesitating to carry it out.

A fourth condition required that the first blow of each hour should be accurate to a second of time. To fulfil this condition the going part should be capable of keeping time within a second for twenty-four hours at

least; but the pendulum is only compensated with zinc; and the enormous surplus force required to drive the hands in all weathers will occasionally reach the escapement and cause it to trip or run forward and the hands to be in error, to the extent of either seconds, minutes, or hours, as the case may be; thus introducing a source of inaccuracy to which gravity escapements are especially liable, and one from which the dead escapement is entirely free. Mr. Denison is responsible for the plan adopted.

A fifth condition required the clock to go and strike eight days with once winding-up. Instead of this the arrangement had failed to the extent of reducing it to a four-day clock, some time since, with the probability of its requiring to be wound up still oftener. For this failure Mr. Denison is responsible.

Another condition appeared in the agreement with Mr. Dent, which required that the clock should be completed and going 12 months in its place to the satisfaction of the Astronomer Royal and Mr. Denison before being paid for; and by finished and going it was of course understood that all the parts of the clock were included, namely, quarter part, hour part, and going part. Yet, notwithstanding this, Mr. Denison gave his certificate, and caused nearly the whole of the contract money to be paid to Mr. Dent's successor more than two years before the clock had been fixed in the building at all, under the plea that the going part alone had been acting satisfactorily in Mr. Dent's shop waiting for the bells; but this was without either the hands or the motion work, or the hour and quarter parts being attached, and under none of the disadvantages of strong winds, snow, and frost, which will exert considerable influence upon them when at their great elevation. In fact to have taken the trial in Mr. Dent's shop as the test of what the clock was capable of doing, was like trying a locomotive for its power without attaching any train to it, and taking the speed it was able to attain as the result which might be expected when encumbered with its compliment of carriages.

The last failure publicly announced is the extreme weight of the minute hands, which the first Commissioner of works has stated in the House of Commons to weigh more than 3 cwt. each. This weight for a minute-hand of only 11 feet radius is incomprehensible, even when allowance is made for the fatality which seems inseparable from the Westminster clock. Instead of 3 cwt. the hands should not have weighed 1 cwt. each, and if the metal had been disposed in the best form for giving the greatest strength with the least weight, they would have been amply strong enough with considerably less than 1 cwt. of metal in each. The first Commissioner of Works added that lighter hands were about to be made, and that it was probable the clock would then work all the four dials in a satisfactory manner. But this anticipation, like others of the past, will certainly be disappointed, for, after computing the weight which suitable hands, counterpoises, motion work, &c., must necessarily amount to for four dials of this size, and allowing for the additional influence of high wind, frost and snow, the force required to overcome the whole will be so great compared with the weight of the pendulum, and the small force, which will be capable of disturbing its time, that there does not appear to me any possibility of the clock maintaining a constant rate within several seconds a day, even though a dead escapement should be substituted for the gravity escapement to prevent tripping, and supposing the clock can be made to go continually thereby. And considering further that other sources of error will prevent the pendulum being increased so as to meet the difficulty, I am quite convinced that a clock with four dials this size can only be made to keep a rate within a second a day, by a similar plan to the one patented by myself, which I submitted to the Astronomer Royal for adoption in the Westminster clock several years ago, but Mr. Denison had then so far usurped the control over the clock as to prevent any plans being adopted besides his own. In this plan the power employed to drive the hands is completely cut off from the escapement and pendulum which regulate the time, and a small astronomical clock, with all its accuracy and durability, is employed for the time-keeping part, whilst the power available in the large clock for driving the hands, may fluctuate even to the extent of 100 lbs. at the diameter of the centre wheel without affecting the time half a second a day. The plan, moreover, allows the Astronomer Royal's condition to be easily fulfilled for enabling the time to be observed to a second by the exterior minute hands moving quickly over the space of 14 inches once a minute.

The difficulty that was likely to occur from Mr. Denison's plan of regulating the going part by a gravity escapement in direct communication with the hand train, was pointed out to the late Commissioner of Works last February, and in the same letter I offered to undertake the superintendence of the clock, in order to introduce the improvement just mentioned and carry it to successful completion, but the reply seemed to indicate that the Board had not then power to change the superintendence. In fact, Mr. Denison boasted in his book, nearly two years ago, that the Board had taken no less than five opinions from the Attorney-General, the Solicitor-General, and the other law officers of the Crown, to try and "get rid" of his superintendence without being able to do so, and the parliamentary papers show that the law officers were consulted with that object in view.

Concerning the cost of the clock, a great deal of credit has been claimed for the lowness of Mr. Dent's tender, as compared with those of Vulliamy and Whitehurst, and the difference between them has formed one of the principal reasons for giving the contract to Mr. Dent; but we now see that the clock once secured, with Mr. Denison as referee, all idea appears to have ceased of its being carried out according to the original conditions, upon which the others tendered, and a much easier way is adopted of making up for the low tender. Mr. Denison, having fairly established himself in the double position of designer and referee, acting professedly for the Government, begins the process by causing the material to be altered from expensive gun-metal to cast-iron, and the contract price, instead of being lowered, to be raised from £1,600 to £1,900, partly under the plea of iron being more expensive to work; and then the next step is to dispense with the said workmanship altogether, but retain the full price in the contract, thus evading not only the original workmanship which gun-metal wheels would have necessitated, but the additional labour of cast-iron, for which the extra sum was added. And then as each failure occurs in the plans of Mr. Denison, the designer and the Astronomer Royal's conditions of construction are sacrificed after each other. Mr. Denison the referee is ever ready to put a bold face on the matter and pronounce the sacrifice of the conditions as really the best thing that could have happened, and modestly intimates that the Government is fortunate in having the man "who understands the subject better than any one else in England." Mr. Dent's original estimate for the entire clock was, as we have seen, £1,600, but what the sum may have reached under Mr. Denison's management, now that the principal advantages of the clock have been sacrificed, there is no available evidence at present to show.

Having briefly sketched the failures that have occurred and those which are likely to follow, with regard to the clock, and shown who is responsible for them, I purpose giving a smilar sketch concerning the bells in my second letter.

Yours, &c.,

E. T. LOSEBY.

30th July, 1859.

COLONISATION OF BRITISH INDIA.

42, Basinghall-street, 11th August, 1859.

SIR,—I beg to communicate to you the following extract from the last despatch from Darjeeling, dated 31st May, as it is of great interest to intending settlers, who may address Frederick Brine, Esq., Hope Town, Darjeeling.

I am, &c.,
HYDE CLARKE.
Agent for British settlers in Darjeeling.

"Our memorial to the Bengal and Supreme Governments was forwarded three or four days ago to Mr. O'Donnell. I send you a copy of it. It contained the signatures of nearly all Darjeeling, including that of the Maharajah of Budwan, and will be signed in Calcutta by all those who are interested in land in Darjeeling. Copies of our former memorial, and of Lord Stanley's reply, and of your letter to Lord Stanley, have been forwarded with the present memorials.

"The Darjeeling Land Rules are out, and I send you a copy of them. Land can now be purchased in fee simple for 10 rupees per acre, payable in ten years, at one rupee per annum. Capitalists who wish to come out from England and invest in land, should lose no time, as large applications are coming in from Calcutta.

"I shall be happy to supply information to intending emigrants, and I shall be able to recommend to capitalists who come out respectable and trustworthy assistants, experienced in the language and customs of the country. Such assistance will be in requisition. My residence, uninterrupted, of 28 years in India has made me acquainted with a large circle of practical honest men, and I know many who would be glad of obtaining appointments in the hills for the sake of the climate.

(Signed) "FRED. BRINE, Hon. Sec."

RULES FOR THE GRANT OF WASTE LANDS IN DARJEELING TERRITORY.

1. Grants of waste land in the Darjeeling territory shall be sold by auction, at an upset price of 10 rupees an acre.

2. Sales of grants of waste lands shall be made from time to time at the office of the superintendent of Darjeeling, on application for that purpose by intending purchasers, in such manner and under such rules as may be laid down for that purpose by the Board of Revenue, full and sufficient notice of the day of sale and other needful particulars being given to the public; should it in any case be deemed inexpedient to grant the land applied for, the superintendent shall refer such case, with his reasons for deeming the grant inexpedient, for the orders of the Board.

3. Every grant proposed to be sold shall first have its boundary cleared and its area determined by an officer appointed for that purpose by the superintendent.

4. No grant shall be of less than fifty acres.

5. A purchaser at auction, of such grant or grants, shall make a deposit, at the time of purchase, of ten per cent. on the amount of purchase money.

6. The balance of the purchase-money shall be paid in annual instalments of ten per cent. on the amount of purchase-money, and in default of such payment the sale shall be considered void, the deposit and any prior payments of instalments being forfeited to Government, and the Government shall be at liberty to re-sell the land on its own account.

7. The Government reserves to itself the right of making and constructing such roads and bridges as may be necessary for public purposes in all lands purchased as above, and also of such indigenous timber, stone, and other materials as may be required for making and keeping the said roads and bridges in repair. Land taken for these purposes shall be paid for at the rates at which it was purchased, by refund of the money paid for it; and compensation shall be granted, when claimed for any damage done to the plantation in the construction of the works.

8. The sale shall convey a title to all mines and minerals within the limits of the grant sold; but a tax not exceeding ten per cent. on the gross produce of such mines and minerals shall be levied by the Government in such manner and under such rules as may hereafter from time to time be determined on.

9. Existing grants may be commuted under these rules at the option of the grantees.

Proceedings of Institutions.

LEICESTER CHURCH OF ENGLAND INSTITUTE.—In the first Report of this Institute, which has only existed since April 1858, the Committee say that they have good reason to be satisfied with the progress which it has already made. What has already been effected encourages the hope that the object for which the Institute was set on foot—namely, to exercise a salutary influence over the young men of Leicester and of its vicinity, may be ultimately secured. The Evening Classes for instruction, which several gentlemen have so kindly undertaken to conduct, have been fairly attended, and, as it is hoped the sequel will show, are steadily and unostentatiously doing their work. No lectures have as yet been delivered; not that the Committee underrate this mode of instruction, but that they feel assured that however useful lectures may be, as conveying general notions of any science or pursuit, all real solid information can be gained only through the medium of classes and of private application. Still they have it in contemplation to make arrangements for the delivery of lectures from time to time, as shall seem most expedient. A commodious house, well adapted to the purposes of the Society, containing a lofty and spacious Reading-room, a Library, and Class and Chess-rooms has been engaged. A room is set apart for the accommodation of the clergy and other senior members, especially those not residing in the town, as a place in which to transact business, write letters, or wait for appointments. The chess-room will also be granted during the morning and afternoon of any day as a place for Committee Meetings of Societies connected with the Church of England, of which the want has long been felt.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

PAR. No.

Delivered on 30th July and 1st August, 1859.

82. Bills—Weights and Measures Act Amendment—(Amended).
83. ,, Charitable and Provident Societies.
84. ,, Coinage.
85. ,, Stamp Duties.
86. ,, Probates and Letters of Administration (Ireland).
87. ,, Reserve Volunteer Force of Seamen.
88. ,, Government of India Act Amendment.
78. ,, Dublin Police.
89. ,, Endowed Schools (as amended by the Select Committee).
90. ,, Sale of Gas.
91. ,, Fireworks Act Amendment (Amended).
92. ,, Turnpike Trusts Arrangements.
93. ,, Turnpike Acts Continuance.
94. ,, Customs.
95. ,, Court of Probate, &c. (Acquisition of Site) (No. 2).
96. ,, Sessional Divisions.

Prussia—Further Despatch from Lord John Russell to Lord Bloomfield.
Public Works (Ireland)—27th Report.
Militia of the United Kingdom—Report of the Commissioners.
Abolition of Turnpike Gates and Toll Bars—Report of the Commissioners.

Delivered on 2nd August, 1859.

102. Printed Papers (presented by Command)—Return.
97. Bills—Customs (No. 2).
98. ,, Chester and Holyhead Railway, at Holyhead.
99. ,, Poor Law Boards (Payment of Debts) (amended by the Select Committee).

Delivered on 3rd August, 1859.

119. Income Tax—Return.
128. St. Marylebone, &c., Workhouses—Return.
100. Bills—University and College Estates' Act (1858) Amendment.
102. ,, Metropolitan Police.
103. ,, Chief Superintendent, China.
104. ,, North Western Territories (British America).
105. ,, Speaker of the Legislative Council (Canada).
106. ,, Police (Counties and Boroughs) (Amended).

Delivered on 4th August, 1859.

123. Polytechnic Accident, &c.—Return.
136. William Henry Barber—Copy of Memorial.
101. Bills—Militia Laws Amendment.
107. ,, Divorce Court.
108. ,, Superannuation Act Amendment.

PATENT LAW AMENDMENT ACT.

APPLICATION FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, August 12th*, 1859.]

Dated 23rd June, 1859.

1607. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in machinery for the manufacture of bolts and rivets. (A com.)

Dated 16th July, 1859.

1682. J. Bernard, Albany, Piccadilly—Certain imp. in the manufacture of boots and shoes, and in the machinery or apparatus to be employed therein.
1686. O. Grimshaw, Belfast—Imp. in safety letter boxes or bags.

Dated 20th July, 1859.

1706. W. J. and D. Gradwell, Manchester—Certain imp. in bearings or journals employed in machinery, which improvements are also applicable to the bearings of railway and other wheels and axles.

Dated 21st July, 1859.

1714. C. Tapp and J. B. Tapp, Chesterfield, Derbyshire—Imp. applicable to steam boilers and furnaces for consuming smoke and economising fuel in the generation of steam, and in the apparatus connected therewith.

Dated 26th July, 1859.

1734. W. H. Buckland, Maesteg Iron Works, Glamorganshire—An improved preparation of peat.
1736. P. D. Mickles, Syracuse, New York, U.S.—An improved spring for railroad and other carriages, and for other uses and applications where springs are required. (A com.)
1737. J. Hinks and G. Wells, Birmingham—An imp. in, or a substitute for, the hook of the ordinary hook and eye dress fastening.
1738. J. Gillott and J. Morrison, Birmingham—New or improved machinery for the manufacture of the handles of penholders, which machinery or a part or parts thereof may also be employed for manufacturing other cylindrical articles.

Dated 27th July, 1859.

1740. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved comb-cleaner. (A com.)
1742. J. Davies, Tetbury, Gloucestershire—A new or improved self-adjusting ventilating apparatus.
1744. J. Scoffern, 4, Barnard's Inn, Middlesex—Imp. in waterproofing, cementing, and stiffening fabrics and fibrous materials, and also in dyeing fabrics and fibrous materials.

Dated 28th July, 1859.

1746. W. Hudson and C. Catlow, Burnley, Lancashire—Certain imp. in looms for weaving.
1747. E. Hunt and H. D. Pochin, Salford—Improved resin and resinous substances.
1748. A. Sidebottom, Crown-street, Camberwell, Surrey—Imp. in the mode or process of separating animal fibre from mixed fabrics of animal fibre and cotton or other vegetable fibre.
1749. C. W. Smith, Evans, New York—Imp. in electric telegraphs, and in the apparatus connected therewith.
1750. W. Kent, Paternoster-row—A self-acting fan.
1751. J. W. D. Brown, Lewisham, Kent—Imp. in signal and light-house lamps and lanterns.
1753. W. E. Newton, 66, Chancery-lane—Imp. in grinding mills. (A com.)
1754. W. Clark, 53, Chancery-lane—Improved apparatus for turning over music leaves or sheets. (A com.)
1755. J. Jackson, Church street, Spitalfields—Imp. in metal pens.
1756. P. Robertson, Sun-court, Cornhill—Imp. in the manufacture of beer, ale, porter, and spirits.

Dated 29th July, 1859.

1757. T. Culpin, 25, Royal Hill, Greenwich—Imp. in water-closets, water-cisterns, urinals, baths, lavatories, and other sanitary apparatus, and in the mode of supplying water thereto.
1758. I. M. Lindley, Staley bridge, Chester—Imp. in cop-tubes.
1759. J. Wright, 42, Bridge-street, Blackfriars—An improved method of raising or drawing up the skirts of gowns or dresses. (A com.)
1761. P. A. Viette, 25, Faubourg de Shaerbeek, near Brussels—Imp. in engraving on metal or on other substances decomposable by acids or corrosive salts.
1762. J. Chandler, Deptford—Imp. in apparatuses for indicating the water level in boilers, and other vessels, parts of which are also applicable for inspecting the interior thereof.
1763. T. J. Terrell, Poplar—An imp. in ships, riding bits, and timber heads.
1764. A. V. Newton, 66, Chancery-lane—Certain imp. in that class of fire-arms known as revolvers, and in bullets for the same. (A com.)

Dated 30th July, 1859.

1765. J. Wood, York City—An improved truss for hernia.
1767. G. Gurney, Woodleigh, Cornwall—Imp. in electric telegraph conductors.
1769. T. Firth, Sheffield—An improved breech-loading cannon.
1771. A. B. Wilson, Cockermouth—Imp. in the manufacture of hats.
1773. P. M. Parsons, Arthur-street West, London-bridge—Imp. in switches and crossings of railways.

Dated 1st August, 1859.

1775. J. Mollady, Manchester—An improved form or construction of hat, cap, or covering for the head.
1777. T. G. Messenger, High-street, Loughborough, Leicestershire—Imp. in the construction of buildings or erections to be used for horticultural or other purposes.
1779. J. Rowland, Salisbury—An improved apparatus for mashing and mixing.
1781. W. E. Newton, 66, Chancery-lane—An imp. applicable to salinometer cases for steam boilers. (A com.)

Dated 2nd August, 1859.

1783. J. C. Ashwell, Dorchester street, New North road—Imp. in wheels for railway and other carriages.
1785. H. Olorenshaw, Coventry—An imp. in neck-ties.

INVENTION WITH COMPLETE SPECIFICATION FILED.

1840. G. T. Bousfield, Loughborough-park, Brixton, Surrey—A new and useful method of manufacturing the vulcanized compounds of vulcanizable gums. (A com.)—9th August, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, August 12th*, 1859.]

August 12th.

408. J. Parkinson.
410. C. Sanders.
414. R. Clegg, F. Angerstein, and J. W. Page.
420. W. Raymond.
421. J. Paterson.
423. G. Bedson.
426. S. Bailey.
428. C. E. Wright.
446. T. Cattell.
447. F. W. Emerson.
448. C. Fay.
461. W. Clay.
452. W. Basford.
464. C. F. Vasserot.
467. F. P. J. Van den Ouwelant.
469. O. Blake.
471. T. Wilson.
475. R. Jobson.
477. R. W. Johnson and W. Stableford.
490. S. Ridge.
507. E. Price and E. Hawkins.
514. R. Fielden, jun., and T. Fielden.
520. J. Lee.
528. G. Horner.
539. Rev. H. Moule.
547. P. Currie.
557. J. H. Johnson.
584. W. P. Savage.
585. F. Verdeil and E. Michel.
604. C. Mills.
665. J. M. Denys.
704. W. and S. Pickstone.
739. J. Evans.
768. M. A. Muir and J. Mc Ilwham.
811. W. E. Newton.
867. R. Postlethwaite.
896. H. F. Gardner.
908. W. H. Barlow.
1033. T. A. Weston.
1098. J. Childs.
1124. J. Scholfield and W. Cudworth.
1194. W. Warne, J. A. Fanshawe, J. A. Jaques, and T. Galpin.
1249. G. R. Sampson.
1258. T. S. Cressey.
1265. J. H. Mason and G. L. Baxter.
1272. N. S. Dodge.
1274. N. S. Dodge.
1286. M. A. F. Mennons.
1299. J. Reynolds.
1302. J. Young.
1375. E. Gill.
1400. A. V. Newton.
1415. J. James.
1448. C. Wilkinson.
1453. E. A. Cutler.

[*From Gazette, August 16th*, 1859.]

August 16th.

474. P. Spence.
478. J. Schless.
485. E. Lund.
486. R. A. Brooman.
488. W. Gossage.
491. W. Ashton.
493. U. Scott.
495. S. R. Samuels.
498. H. B. Barlow.
503. J. Crosland.
504. A. Lançon, junr.
575. J. Cowban and E. Andrews.
586. G. Leach.
598. J. P. Clarke.
643. T. Lightfoot.
655. J. Dixon and R. Clayton.
770. B. Smith and C. L. Smith.
1189. D. Foxwell.
1275. A. V. Newton.
1392. R. R. Fairgrieve and S. Bathgate.
1394. J. Henderson, W. Henderson, T. Bagley, and S. Holdsworth.
1428. A. V. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, August 12th*, 1859.]

August 8th.

1881. A. L. Reid.

[*From Gazette, August 16th*, 1859.]

August 11th.

1900. A. Priest and W. Woolnough.

August 12th.

1899. E. Hallen and W. H. Kingston.
1917. J. W. D. Brown and G. G. Brown.
1952. J. Crossley and J. Bolton.
1988. E. A. Cowper.